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SELECTED TRANSLATIONS ON EAST EUROPEAN MATERIALS INDUSTRIES

No 1

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SELECTED TRANSLATIONS ON EAST EUROPEAN MATERIALS INDUSTRIES

No 1

This is a serial publication containing selected translations on the fuel, electric power, mining, metallurgical, and construction materials industries in Eastern Europe.

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BULGARIA

EXPLOITATION OF COAL DEPOSITS IN BULGARIAN PEOPLE'S REPUBLIC

[Following is the translation of a pamphlet by A. N. Shcherban', published by the Ukrainian Academy of Sciences, Kiev, 1959]

PREFACE

The industrious Bulgarian people led by its battle-hardened communist party, set out on the wide road of free development, on the path of joyous creative labor on the road of Socialism, on 9 September, 1944.

Prior to the victory of the people's revolution, Bulgaria economically was one of the most backward countries in Europe. The people's government in Bulgaria, during the very first days of its existence, nationalized the basis economic enterprises of the country-railroads, hydro-electric stations, mines, ship building yards and banks, this made it possible to strengthen and to broaden the socialist sector of the national economy and to realize a transition to the planned development of the country's economy.

The successful fulfillment, under the leadership of the Communist party of Bulgaria, of the 2-year economic plan for the reconstruction and development of the country (1947-1948), as well as of the first (1949-1953) and of the second (1953-1957) fove-year plans (see Table 1), has secured the transformation of agrarian Bulgaria into an industrial-agrarian People's Republic of Bulgaria.

This is clearly demonstrated and supported by the ratio between the gross product of industry, on one hand, and of agriculture, on the other: in 1939 it was 24.8: 75.2 in favor of agriculture, but in 1957 -- 63.3: 31.7 in favor of industry.

n The successful development in Bulgaria of the ore mining industry, such as the mining of lead-zinc, copper, manganese, and iron ores, creates favorable conditions for the development of both ferrous and non-ferrous metallurgy.

In Bulgaria at the present time the output of lead-zinc ore amounts to approximately 1.5 million tons, and that of copper ore to approximately 500 000 tons.

Table 1

Index	Production Increases, %					Plan for 1960 in % over 1957.
	1953 to 1952	1954 to 1953	1955 to 1954	1956 to 1955	1957 to 1956	
Electric Power	115	111	119	116	111	168
Coal	113	107	115	109	110	160
Nitrogehous fertilizers	149	108	107	110	116	640
Cement	105	111	104	106	102	200
Cotton Fabrics	108	105	111	108	108	138
Wool Fabrics	113	---	106	120	105	136
Leather	109	103	105	133	120	---
Meat Products	104	112	124	112	115	131
Meat	139	---	109	114	107	127

The Lenin Metallurgical Works, built in 1954, yearly produces 200,000 tons of cast iron and 250,000 tons of steel.

The discovery of the Kremikov iron ore deposits facilitates further development of metallurgical industry in the country.

The building of a tin-zinc plant, with a yearly capacity of 40,000 tons of tin and 30,000 tons of zinc, is almost completed; it will increase the production of those metals almost 50%.

Prior to the establishment of the People's Government, Bulgaria imported only the most simple implements scythes and sickles, but at the present time the People's Republic of Bulgaria itself produces complex equipment for the mining and oil industries; pumps, compressors, steam boilers, conveyors and so on.

The coal industry is developing also quite successfuly in Bulgaria. Compared to 1939, the output of coal in 1952 amounted to 235%, and in 1956 to 479%. The coal output per capita was 1,500 kilograms in 1957 but 1,890 kilograms are planned for 1960 and 2,800 kilograms for 1965.

The Communist Party and the Government of the People's Republic of Bulgaria devote much attention to the increasing of the material well-being of the toiling masses. The real income of workers and employees has grown by 42.7% between 1948 and 1956, and by the end of 1957 by 60% as compared with 1948.

The broad economic and scientific technical cooperation with the USSR, the selfless aid extended by the Soviet Union, as well as strong economic ties between Bulgaria and the countries of the People's democracies, play an important role in the development of the Bulgarian

Peoples' Republic.

The industrious Bulgarian people are confidently striding towards their even brighter tomorrow, as an equal among equals in the family of fraternal nations of the Socialist camp.

COAL DEPOSITS OF BULGARIA*

The Bulgarian anthracite industry began to develop at the end of the nineteenth century. Information has been preserved which points out the fact that the coal deposits of the Balkan anthracite basin were being exploited in the middle of the last century. In 1850 the garrison of Sofia used coal as fuel for heating. This anthracite was mined at the former state mines "Pernik" of the Dimitrov anthracite deposits.

Owing to the absence of large coal consumers, the development of the anthracite industry in old Bulgaria proceeded very slowly. It was only the building of new railroads, as well as the growth of industrial enterprises, which conditioned a more rapid development of the coal industry.

Four kinds of coal are represented in the Bulgarian coal industry; anthracite, hard black coal, brown shiny coal, and brown lignite coal. To the brown coal belong coals of brilliant shine and dark color, which have the characteristics inherent to this kind of coal.

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* The author expresses his profound gratitude to the Bulgarian mining engineers D. Ivanov and I. Boichev for their valuable work in the selection of data used in the preparation of this pamphlet.

To the lignite group belong all the remaining kinds of brown coal with a dull sheen, -- from dark to light brown color.

To the typical representatives of shiny brown coal belong coals produced at the mines; "Pirin", "Bobovdol", "Temelko-Nenkov", the G. Dimitrov mines and so on; to the representatives of the lignite coal belong coals produced at the mines "Chukurovo", "Bystritsa", "Martos", "Bol'shevik" and others.

In terms of their geological age the Bulgarian coals are; Carboniferous (Anthracites); Jurassic and Upper-and Lower Cretaceous; Turon (Hard); Old Tertiary (Shiny Brown Coals); and New Tertiary (predominantly lignite).

The coal deposits of Bulgaria are situated for the most part in the southern and south-western parts of the country. The distribution of Bulgarian coal deposits by kinds of coal is presented in Table 2:

Table 2

Coal	Reserves for 1/1/1957 in categories A+ B+C		Conversion into conditional fuel, equalling 7000 kilogram calories per kilogram		
				Reserves	
	millions of tons	% to total reserves in the country	Conversion Coefficient	millions of tons	% to total reserves in country
Anthracite	14.2	0.4	1.00	10.2	1.0
Hard Black	20.0	0.8	0.72	20.8	2.0
Shiny Brown	294.7	8.1	0.51	150.0	14.4
Lignite	3317.6	90.7	0.26	862.0	82.6
Total	3655.5	100	0.286	1043	100

Anthracite Deposits

Anthracite deposits are known mainly in the Iskor, Vrachan, and Sofia parts of the Balkan mountains. Anthracite deposits are also located in the Belgrade area.

The richest deposit is that near the railroad station Svoge (Fig. 1, No 1), being developed by "Anthracite Mines", which yield the greatest output of anthracite.

The productive veins of anthracite in this deposit ore formed by conglomerates, sandstone, argillaceous schists.

Eight coal veins have been discovered in the deposit area and four of them are being exploited.

As a result of techtonic processes the thickness of the veins is variable, (0.3-1.4 metres); local thickening in the form of "Lenses" is observable. In certain sectors the coal is fragmented and mixed in secondary vein formation with sand and layers of soil.

The angles of incline of the veins differ. However, steep angles of incline (45-90 degrees) do predominate.

Two following sorts of anthracite are distinguished in terms of their structure and external characteristics: the crystallic, which corresponds to the primary vein formation, and amorphous, which was

obtained as a result of secondary formation.

The crystallic anthracite contains 7% moisture, 25-30% ashes, 0.7-1.5% sulph, 2-5% of volatile particles; and its calorific capacity equals 5,500-7,000 kilogram-calories per kilogram.

Amorphous anthracite is characterized by a higher quantity of ashes as ingredient, (up to 50% in dry mass) and by a lower calorific capacity. However, anthracities with low percentage of ashes as ingredient are also met on individual sectors. Thus, for instance, the mine "Draganitsa" (the Berkov rayon) is exploiting an anthracite vein with an ash-content of 12-17%, while the average ash-content of coal veins of this deposit area amounts to 30%.

A peculiarity of production of Bulgarian anthracites -- lies in the resultant yield of a great percentage of small-grain coal (up to 15-17% of the 25 millimetre class).

The production of anthracite mines currently in operation does not exceed 500 tons per twenty four hour period.

An anthracite deposit has been also discovered in Kireyevo (Kul'skiy rayon). This deposit is being investigated at the present time.

Significant work of geologic-exploratory nature is being conducted in other areas of the country as well, as a result of which the general reserves of anthracite in Bulgaria will be increased.

Deposits of Hard Black Coal

All of the known deposits of this coal in Bulgaria belong -- in terms of their geological age -- to the Lower Jurassic Period and Upper Cretaceous Period (Turonic).

To the Lower Jurassic Period belongs coal from the mine "Vreshka Guka" near Kireyevo, where a vein with a thickness of 0.5-11 metres is being exploited. This vein is divided by a siliciumized sub-layer into two veins of varying thickness.

The thickening of the vein took place as a result of techtonic changes in the deposit's strata. The angle of incline of the vein is approximately 90 degrees.

That portion of this vein's coal which had been crushed and fragmented yields much small-grain and powdery coal. The moistness of the coal is 5-7%, ash-content in dry mass is 7-18%, content of volatile particles is 10-12%; calorific capacity of this coal is approximately 7,000 kilogram-calories per kilogram.

This stratum has been nearly exhausted by the mine, but a lower-lying vein, with a thickness of 0.4 metres, had been discovered in the process of exhaustive exploitation of the upper vein.

Veins of hard black coal have been also discovered near the villages of Lesi (Tetivenskiy rayon), Golyany (Troyanskiy rayon) and Tuden (Godyachskiy rayon). However, because mining and geological conditions here have not as yet been investigated, the quantitative and qualitative characteristics of those deposits are unknown.

The principal, as well as the best studied, reserves of hard black coal belonging to the Upper Cretaceous Period (Turonic) are located in the middle Balkans within the boundaries of the Balkan hard coal deposits, which are spread out from the city of Gabrovo to the city of Sliven (Fig. 1, No 2).

The productive thickness of this deposit, of a general depth of some 100 metres, consists of argillaceous schists, marls, and sandstone. The deposit area contains eight coal veins which have different name designations at various operating mines.

At some of the operating mines the coal veins are designated by Roman numerals from one to eight, at other mines they are given such name designations as "America", "The Southern One", "The New One", "Methodius", "Cyrill", "Hope", and others.

The vein thickness varies from 0.3 to 1.5 metres; thickenings up to five metres appear rarely. The angle of incline is 45-90 degrees.

The veins contain much ash and sulphur. Ash-content varies within wide limits, the average ash-content in dry mass being 25-30%.

New veins of hard black coal have been discovered with over 40-50% of ashes, 0.8-4% of sulphur, and 10-40% of volatile particles.

All hard black coal deposits are highly gasogenic. The majority of the veins belong to the second and third category in terms of gas; however, there are some which go beyond the categories. Sulphuric precipitation as well as sudden eruptions of coal and gas have been noted. They make operations in the production of coal from the Balkan deposit areas difficult.

There is reason to assume that the sudden eruptions of coal and gas will be more frequent at greater depths.

At the present time mining operations at the Balkan coal deposit area have reached a depth of 300 metres; sudden eruptions of coal and gas began at a depth of 150 metres.

Within the boundaries of the Balkan natural deposit areas of hard black coal the following state enterprises are operating; "Lion" with its management center at the railroad station Plachkovtsy; "Tverditsa" with its management center at the mine Tverditsa, 13 kilometres from a station of the same name; "Chumerna" with its management center at the Chumerna station (Slivenskiy rayon), and the "Slivenskiye" mines.

In 1955 those concerns were united under a single management situated in the city of Sliven.

The productivity of most of those mines is low and only at one enterprise (the Slivenskiye mines) amounts to over 500 tons per 24-hour period (at projected-capacity of 725 tons per 24-hour period).

Hard black coal of the same geological age (Turon) is encountered also in the western part of Bulgaria and in the eastern part of the Balkans.

In the western part of Bulgaria well known are the natural deposits of hard black coal near the village of Gorno Ozerovo (Vrachanskiy rayon), where four coal veins with a thickness of 0.16 to 0.3 meters have been studied; and near the city of Belogradnik -- two veins, one of which is being exploited by the mine "Zelenyy Grad".

Veins of hard black coal have also been discovered in the villages of Gorno and Dolno Luka (Mikhaylovgradskiy rayon).

The hard black coal reserves satisfy the needs of the metallurgical industry of Bulgaria as far as coke is concerned (300,000 tons of coke per year). However, mining-geological and coke-chemical investigations of the above noted natural deposits areas are being continued in view of the growing demand for coking coals on the part of the ferrous metallurgy.

Natural Deposits of Shiny Brown Coal

This coal is widely used both in industry and by individual consumers in Bulgaria. Natural deposits of this coal have been well reconnoitred the quantity of their reserves made more specific as is shown in Table 3.

Table 3

Deposit	Method of Working	Reserves of Shiny Brown Coal as of 1/1/1957, in Categories A+ B+ C		Ash-Content (%)
		million tons	% of total reserves in the country	
Dimitrovo		145.1	4.0	43.9
"Temelko-Nenkov" Mine	Subterranea	98.7	2.7	44.3
"G. Dmitrov" Mine	Surface	46.4	1.3	42.8
Bobovdol	Subterranea	89.5	2.4	39.1
Pirin	"	21.5	0.6	36.0
Black Sea	"	35.9	1.0	38.0
Nikolayevo	"	1.6		45.1
Borovdol	"	0.77	0.1	32.0
Samokov	"	0.15		28.0
Total	Subterranean 84% Surface 16%	294.7	8.1	40.4

The Dimitrov Deposits are located thirty kilometres from Sofia (See Fig. 1, No 3). This natural deposit area has been studied in detail; its reserves constitute approximately 50% of the country's total

reserves of shiny brown coal. When the amount of reserves was being made more exact, layers with an average ash-content of 55% at stratum depth of 0.8 metres were taken in the capacity of conditional; with respect to already established reserves the average ash-content of those veins amounts to approximately 40%.

Four coal layers, counting from bottom to top — A, B, C, and D, are known at this deposit area. Three of those are being normally mined. They are A, B, and D. In 1955, an experimental mining of the vein was conducted in the area of the "Temelko-Nenkov" mine.

In the area of the mines in the Dimitrov depository, the upper schist of vein D together with vein B are nearly exhausted; therefore, it is vein A and the lower sub-strata of the vein D that are being worked for the most part.

The thickness of vein A equals 1.2-1.8 metres; that of vein B, 2.0-2.6 metres. The thickness of vein D is relatively constant and varies only within the limits of 0.8-1.0 metres, for the lower section, and up to 3 metres for the upper section. The angle of incline for the veins is 3-25 degrees.

At the Dimitrov deposit, coal is produced by subterranean (Fig. 2) as well as by surface excavation (Fig. 3) methods.

At the present time nine mines, with a productive capacity of over 500 tons per 24-hour period each, are operating. All of the mines of this deposit area are dangerous due to their gasogenic character. The coal is ignites spontaneously.

Four active coal pits are united into the G. Dimitrov coal enterprise. The productivity of the pits amounts to 4,000 tons per 24-hour period.

In 1956 these deposits yielded approximately 80% of the country's total output of shiny brown coal.

The reserves of the Dimitrovo deposit are limited. Therefore a certain curtailing of its productivity is projected from 1957 on.

Bobovdol Deposits. The country's second in reserves and in the output of shiny brown coal (Cf. Fig. 1, No 4). It is situated in the vicinity of the village Bobovdol (Stanke-Dimitrov rayon) and is connected with the city of Stanke Dimitrov by means of a railroad. Five productive coal veins are known; "Grebikal", "Pomeraviya-Konstantinov", (Double), "Hope", and a vein under "Hope".

The coal veins here extend to the depth of five hundred metres. The distance between individual veins reaches ten to thirty metres, (Cf. Fig. 4). The thickness of the veins is variable -- 2 to 6 metres, and that of the vein Pomeraviya-Konstantinov exceeds 6 metres.

The ash-content of the veins varies within the limits of 5-50%. Grebikal is the purest vein, Hope has the highest ash-content. The average ash-content of the coals of the Bobovdol deposits is 39%.

Because the deposit area had suffered a strong techtonic disruption, the angle of incline of the veins amounts to from 10-90%. Four mines with a productivity of 500 tons per 24-hour period are engaged in the exploitation of those deposits. The construction of a mine with

vertical shafts 200 metres deep is being completed at the present time.

In 1956 those mines obtained 8% of the country's total production of shiny brown coal.

All of the Bobovdol mines have a gas danger. Piper precipitations of methane are observed. The coal is subject to spontaneous ignition, so that consequently a special anti-fire system has to be observed at the mines. It is possible that the danger of conflagration will increase as work is carried to greater subterranean depths. Hence a new system of mine exploitation designed to lower production losses, which at the present time amount to approximately forty per cent, is being worked out.

The Bobovdol coal deposits are regarded as one of the most promising because they make it possible to produce 2 million tons of coal per year over a period of 40 years. The development of this deposit area is being speeded up because of the exhaustion of the Dimitrov deposits.

A detailed geological study, oriented upon a contouring of the deposit and towards a precise specification of the amount of its reserves, is continuing.

The Pirin Deposits are located near the village Brezh (Blagoyevgradskiy rayon) (Cf. Fig. 1, No 5).

One vein of coal with a thickness of 5-30 metres is being mined here. This coal vein is separated by sub-layers of argillaceous schist. These deposits are highly gasogenic. The coal of this depository is the best kind of shiny brown coal. Two mines, connected by one cable road and one narrow-gauge railroad with the station Orlovets, are operating here. The productivity of those mines in 1956 constituted 5% of the country's total production of shiny brown coal.

Long range plan of development forsees a gradual increase in the production of shiny brown coal from this depository area to 400-500,000 tons per year.

Black Sea Deposits of shiny brown coal are situated thirteen kilometres north-west from the city of Burgas (Cf. Fig. 1, No 6).

Out of the five veins comprising this deposit area, three are being presently exploited. The veins are designated by Roman numerals one to five, counting downward. A sketch of the geological cross-section of the deposits is presented in Fig. 5. Owing to the fact that the coal veins are situated below the level of the Black Sea, the deposits are saturated with water. The influx of water amounts to 14-16 cubic metres per produced ton and increases to 25-30 cubic metres per ton at certain periods.

The presence of hygroscopic clays between coal veins makes the utilization of wooden timbering supports impossible and necessitates the use of reinforced concrete segments and blocks, as well as of metal rings, for support in main excavations.

Two mines are operating on this deposit area. They are connected with the rail-road by a narrow-gauge line. Those mines are: The "Ninth of November", with a depth of 120 metres and with a productivity

of over 500 tons per 24-hour period, and the slanted one -- "Brigadir", with a productivity of 300 tons per 24-hour period.

The yield of this deposit area amounted in 1956, to 3% of the country's total output of shiny brown coal during that year.

The Black Sea deposits of shiny brown coal are the only ones in south-eastern Bulgaria, and therefore long-term planning foresees a significant increase in their yield of coal.

Mining-geological investigations, concerned with determining the contours and the reserves of the deposit, have discovered coal veins at depths of over 400 meters, and the coal there is qualitatively substantially better than that which is presently being mined. Ash-content of those veins does not exceed 12-15%.

The Nikolayevo Deposits are located in the Kasanlykskiy rayon. Two highly gasogenic veins with a general thickness of 2.5 metres are being worked. One slanted mine is in operation here. Due to insignificant output it has only local importance. The coal is transported away by truck.

Geological prospecting is being conducted in the Kazanlyk valley at the present time. The object is to determine the exact reserves of the deposit, which is of great importance for the national economy, due to the fact that this deposit area is located in the center of the country.

The Borovdol Deposit is situated near the village Borov dol (Sliven rayon) and consists of four veins, two of which are being worked. The thickness of the two upper veins (being exploited) is 1-2 metres, that of the two lower veins not being mined is 0.3-0.4 m. Local increases in the thickness of the upper veins up to 7-9 m are noted. The angle of incline is 60%.

The veins are gesogenic, the coal is spontaneously igniting; fires in the mines happen quite frequently.

This deposit is being exploited by slanted mines united under one general name "Chumerna". Their output does not exceed 150 tons per 24-hour period. The mines are connected with the railroad station Chumerna by a cable line.

This deposit has been sufficiently investigated and has only local significance. No additional reserves of coal are contained here. Hence, the long-range outlook with respect to the development of this depost is poor.

The Samokov Deposit. Near the city of Samokov, in the vicinity of the village Dosney, are located rather small reserves of shiny brown coal, which are being exploited by the slanted mine "Rila". Two veins, with a general thickness of 1.5 -- 2.0 metres, are being exploited. The output of the mine is 12,000 tons per year. The coal is gasogenic and spontaneously igniting. The produced coal is taken to the city of Samokov by truck.

This deposit area has been little studied, but there are reasons

to suppose that it will have only a local significance.

NATURAL DEPOSITS OF BROWN COAL (BULGARIAN LIGNITE)

Characteristies of the brown coal (Bulgarian lignite) deposits are presented in Table 4.

East-Marish Deposit located around the villages of Lyubenovo, Strakhanovo, Troyanovo (Novozolyarskiy rayon) (see Fig. 1, No 7)

It consists of two veins with a thickness of 15 and 5 m.

The depth at which the veins are found is 20-60 m. The thickness of the veins is made up of coal veins with a varying ash-content. About 40% of the reserves here have a 18-22% ash-content per dry mass, while about 60% of the reserves have an ash-content of approximately 45%.

Owing to the consideration that coal with an ash-content not in excess of 25% is suitable for the production of briquettes without using of binding substances, the building of a briquette factory has been planned at this deposit area.

The veins are exploited by the surface method and the stripping coefficient is 2.8.

The building of a surface-excavation coal pit with a productivity of 10 million tons per year was commenced here in 1954.

Table 4

Deposits	Method of Working	Reserves of Brown Coal (Bulgarian Lignite) as of 1/1/1957, in Categories A+B+C. million tons	% of general reserve in country	Ash Content (%)	Moistness (%)
East Marish	Surface	2847	78.0	18-45	50-60
West Marish	Subterranean	226	6.2	30-45	38-40
Chukurov	"	25.4	0.7	35-40	27-30
Belobresh	Surface	35	1.0	25-45	50
Stanyan	"	41.8	1.2	33	45-50
Aldomirovtsy	Subterranean	38.6	1.1	35-45	45-50
Kurilov	"	17.2	0.5	28-30	40-50
Gotsedel'che	"	10.1	0.3	32	27-30
Kyustendil'sk	"	38.7	1.1	33	28-30
Lom		little investigated			
Gabrovish		not working			
Total	Subterranean Surface	355.2 2918.8	90.7		

In order to obtain cheap coal, (taking into consideration its low calorific capacity) the project foresees the exploitation of this deposit with the aid of the newest machines: excavators with multiple scoops and excavators with rotors, absetzers, electromotives and dump-cars, etc.

The great long-range possibilities of this deposit area and its importance for the development of the national economy of the People's Republic of Bulgaria must be pointed out.

The West-Marish Deposit is the second deposit in size of lignite coal in the country. It is situated in the environs of the city Dimitrovograd (see Fig. 1, No 8). It contains 4 coal veins, 2 of which "Khafuzskiy" and "Kiprenskiy" are being exploited.

In addition to those veins, there exist two others with a common name "the Marish veins", the outcroppings of which have been determined at the edges of the deposit area. The question of their exploitation is not as yet settled with finality. Their thickness is 1-3 m.; their sulphur-content is 5-7%.

The depth at which they run reaches 200 m., and therefore the deposit is being and will be exploited by subterranean methods only.

Considerable difficulties will arise at great depths due to increased pressures and to soil-erosion of the veins. This will necessitated new kinds of shaft-supports in the mines, which will increase production costs.

Five mines, with a productivity of over 500 tons per 24-hour period each, are working here at the present time. All of those mines are connected by means of a railroad line branching off from the mine line.

The production of lignite from this deposit in 1956 amounted to 50% of the average yearly production of lignite in Bulgaria.

Geological prospecting and surveys for the determination of contours and reserves have been finished here.

The Chukurov Deposit (Sophia basin) is located near the village Gabra (Ikhtimanskiy rayon) (see Fig. 1, No 9). Twelve veins of workable and unworkable thickness are known to be within its boundaries. The quality of the coal is median between the shiny and the lignite coal, the sheen is mat, the color is steely; colorific capacity is about 3000 kilogram-calories per kilogram.

The coal from this deposit is easily subject to gasification and is highly valued by its consumers. In 1956 the deposit's yield amounted to approximately 8% of the total production of lignite coal.

One mine is in operation here at the present time.

A coal pit is being constructed and a branch-line (railroad) is being laid to connect the deposit area with the station of Vakarel.

The results of geological survey work give reason to assume that the Chukurov deposits should be exploited by open methods; it has the highest stripping coefficient in Bulgarian industry, 4.8.

The Belobresh Deposit (Sophia basin) is situated near the villages Gaber and Nedelishche (Godyachskiy rayon).

It has one vein of lignite coal with a thickness of 30 metres. Exploitation is conducted by means of surface excavation in "Bol'shevik I" mine with stripping coefficient of 1.

Two sectors are being worked on -- the eastern and the western. Their reserve-ratio is 3:2. The coal is typically lignite -- light brown in color with clearly pronounced traces of wood-remnants. The structure of the coal is earthy. The ash-content is different at each sector: 25% in the western, 45% and higher in the eastern.

Simultaneous exploitation of both sectors will yield fuel with mean ash-content of 37-40%, while the calorific capacity of this mixture will be 1500 kilogram-calories per kilogram.

This fuel will be used exclusively for to generate power. The main consumers of this coal in the near future will be the expanding Stalin TETs (Thermal-Electric-Center) and the thermal-electric stations of the Sophia oblast'.

The yield of coal from this deposit amounted in 1956, to over 500 tons per 24-hour period.

A branch-line connects the deposit area with the Sophia-Drogoman

railroad which ensures the cheap transportation of coal.

Near the station Nedelishche (Godyachskiy rayon), a second deposit of lignite is located. Exploitation is projected by the surface methods for 70% of the reserves, and 30% of the reserves by the subterranean method.

Difficult hydrogeological conditions bring about difficulties in the exploitation of this deposit.

THE STANYAN DEPOSIT (Sophia basin) is located directly near the Yugoslavian border, near the station Stanyantsy (Godyachskiy rayon). About two thirds of the deposits extend into Yugoslav territory. One vein of typical lignite, located in Bulgaria and 20 m. thick, will be exploited by the surface method. The color of the coal is light-brown and its structure is earthy. Approximately one third of this deposit's reserves can be briquetted without the use of additional binding materials. The ash-content of coal suitable for briquetting is 18 to 20%; the remaining coal is good fuel for the generation of power.

The slow exploitation of this deposit is explainable by is location near the border, as well as by the exceptionally difficult terrain of the area, which makes connection with the railroad lines difficult.

The Aldomirovtsy Deposit of lignite lies in the environs of the villages of Aldomirovtsy and Golubovtsy (see Fig. 1, No 10) (Sophia basin). Its reserves are small.

The deposit has two veins: the upper vein with a thickness of 2-3 meters and the lower vein 8-12 meters. The coal is typical lignite, light-brown in color with an earthy structure. Its calorific capacity is 1500 kg-cal/kg.

Two mines are working this deposit: the "Aldomirovtsy mine" (in the village of the same name) and the mine "Plam" (Village Khrabreno). Surface exploitation is projected for the future, except for the mining field being exploited by "Plam". The latter is connected with the Dimitrovo-Valuyak railroad by a branch-line; coal from the "Aldomirovtsy-mine" is transported by truck to the station at Slivnitsa.

The Kurilov Deposit of the Sophia basin is situated near the village Kitino (Sophia rayon).

It contains one vein of lignite, 15-20m thick, and was formerly exploited by the surface mine "Lignite". About half the reserves of the deposit can be worked through the surface method.

The coal from this deposit is a good power-generating fuel (calorific capacity 1600-1800 kg-cal/kg) and can be used by the TETs "Kurilo". The deposit area can be easily linked with a railroad station by means of a cable-line.

The Gotsedel'che Deposit (Sophia basin) is situated along the valley of the river Mesto (Gotsedel'cheskiy rayon) between the mountains Pirin and Rodopy. Of the two veins comprising the deposit, the upper has a 2 meter thickness, the lower 6.7 m. The distance between the veins

is 6-8 metres. The coal has a coffee-black color and a schistous structure. At the present time this deposit is being exploited by the mine "Kanin", located near the village Baldevo. Its productivity is 600 tons per 24-hour period.

The low productivity of the deposit is determined primarily by the absence of a link with the railroad. The laying of a railroad line from the station Dobnishche to the city of Gotse Del'chev is projected in the future. This will undoubtedly increase savings in this deposit's exploitation; the mine has lignite of the best quality with a calorific capacity of 2700-2800 kg-cal/kg.

Geological surveys concerned with the determination of reserve quantity of the deposit is continuing. There is reason to believe that the reserves are considerably larger than the amounts so far determined.

The subterranean method will be probably employed in the exploitation of this deposit.

The Kyustendil'sk Deposit (Sophia basin) is situated in the environs of the villages Nikolichevun, Skrinyano and Svolyano (Kyustendil'skiy rayon) (see Fig. 1, No 11).

Of the two veins making up the deposit, the upper vein has a thickness of 2 m, the lower 9 meters. The thickness of the lower vein is variable. The veins are highly gasogenic. This is the only example of gasogenic lignite in Bulgaria.

Exploitation by the subterranean method led to erosion of the vein-soil, which necessitated a switch-over to reinforced concrete supports in the haulage shafts. Such a costly undertaking significantly incfeased the prime cost of coal.

The high calorific capacity of this coal (3000 kg-cal/kg) insures a wide demand for it.

Coal of the highest quality was discovered in a sector of this deposit located near the villages Nikolichevtsy and Skrinyano; that of the lowest quality near the village Svolyano.

Because of this, the mine near the village Svolyano has been closed and the exploitation of the higher-quality part of the deposit has been commenced by means of sloping shafts.

The deposit is being worked by slanted mines with a 300 ton per 24-hour period productivity. Plans for the future indicate an intensive exploitation of this deposit.

The Lom Deposit of lignite (Sophia basin) is located near the city of Lom (see Fig. 1, No 12). No final estimate of coal reserves has been made here as yet. At the present time they are counted in several tens of millions of tons per C_2 category.

The coal is typical lignite of brown color and arboreous in structure. Its peculiarities lie in the preservation of original lumpiness after drying and in the acquireing (in the process of drying) of the solidity and external appearance of a horn.

Geological survey work has discovered four veins of lignite here. Their general thickness is approximately 10 meteres; that of the lowest

vein 5m. Average ash-content of this coal is 25%; its moistness about 40%; calorific capacity 3000 kg-cal/kg.

Due to strong flooding, the deposit is very difficult to mine. Under the lowest coal vein the pressure of subterranean waters reaches 10 atmospheres. Only additional geological and hydro-geological survey-work will make it possible to come to a final conclusion about the exploitability of this deposit area.

The vertical mine "Pernik" was once built at the Lom deposits. Its main vertical shaft pierced all of the coal veins, including the lowest. Mining along the lowest vein was also carried on. However, due to a water breakthrough, the mine was flooded and further work terminated for the time being.

The Lom depository is of great importance for supplying Northern Bulgaria with fuel. The prime cost of the coal will not be high, because it can be transported along the Danube River.

The Gabrovitsa Deposit of lignite (Sophia basin) is located on the northern slopes of the Rodop mountains in the environs of the village Gabrovitsa.

The deposits are small and are made up of two lignite coal veins: the upper having a 2m. thickness, the lower approximately 3. The coal is brown to the point of blackness, with remanants of arboreous inclusions. Its ash-content is 28-35%, moistness approximately 30%, calorific capacity 2800-3000 kg-cal/kg.

In the past these deposits were worked, until the necessity of more durable timbering, due to pressure of rocks and soil-erosion, made operations uneconomical.

This deposit area has been little studied; the reserves are tentatively estimated in several hundred thousands of tons.

Exploratory mining has been organized at the present time, but there is no reason to believe that reserves here will turn out to be large. Probably the exploitation of these deposits will be limited.

THE OPENING AND WORKING OF THE BULGARIAN COAL DEPOSITS

Natural deposits of coal in Bulgaria are exploited by both the subterranean and the surface methods (Table 5).

With the exception of the G. Dimitrov mine, all the reserves of anthracite, hard black coal and brown coal will be produced by means of the subterranean method. At the same time 73% of the lignite coal reserves will be developed by means of the surface method and only 27% will be underground. 68% of the coals of all types will be exploited by the surface method.

System for Working the Coal Field

The coal deposits, depending upon their character and the depth of the vein are opened by different methods. Of the 54 existing mines

which are worked by the underground method, 3 were opened by vertical shafts, 22 by sloping shafts, and the rest by galleries.

The order of exploitating a coal field is reverse for brown and lignite coals; direct for hard black coal and anthracite. In 1956 6,336,840 tons were produced via the former, and 369,700 tons via the latter order.

The continuous system, with working shafts 30-80 metres in length, is used in the subterranean mining of lignite. The width of the working-shaft faces is 1.5 metres. Collapsing of the soil is done at every other extension of the faces their timbering support is ordinary. Only at the "Pirin" mine (productivity 300 000 tons per year) the cleared [worked-out] space is hydraulically filled up with sand produced in special pits and quarrys and transported to the mine along a cable line.

Table 5

Coal and Deposit	Coal Reserves in % Relative to the General Coal Reserves in the country	Method of Working (%)	
		Surface	Subterranean
Anthracite			
Svoge	100	—	100
Black Hard			
Balkan	82	—	100
West Balkan	18		100
Total	100	—	100
Brown			
Dimitrovo	49.2	32	68
Bobovdol	30.4	—	100
Pirin	7.3	—	100
Black Sea	12.2	—	100
Nikolayevo	0.5	—	100
Borovdol and Samokov	0.4	—	100
Total	100	16	84
Lignite			
East Marish	85.8	80	20
West Marish	6.8	—	100
Belobresh	2.15	80	20
Chukurov	0.75	70	30
Stanyan	1.3	90	10
Aldamirovtsy	1.1	80	20
Kurilov	0.5	50	50
Gotsedel'che	0.3	—	100
Kyustendil'sk	1.2	—	100
Rest	0.1	—	100
Total	100	73	27

Variations on the systems presented in Figs. 10-12 are used in the mining of hard black coal deposits via the subterranean method.

In the mining of anthracite deposits the usual continuous system of mining is used with a division of the levels into sub-levels.

The system of ascending ventilation is used in all working-shafts

regardless of the category of gas /gasogenic category/.

Productivity of labor varies in underground mining work from 0.5 tons per shift in the mining of hard black coal to 2 tons per shift in the mining of lignite.

Surface Mining

The following open pits were operating in 1956 at the Dimitrovo deposit.

1. The "9th of September": 500 000 tons per year at a 1.66 stripping coefficient. This open mine is working on reserves left behind by the "Khristo Botev" mine, which had left unexploited about 40% of the coal field, due to employment of uneconomical systems.

2. "Republic I": 1.5 million tons per year at a stripping coefficient equalling 0.78. The thickness of the vein is 20 m. Reserves of this open mine were exhausted in 1958.

3. "Republic III": 1 million tons per year, stripping coefficient, 1.14. In 1956 plans were made to increases production here to 1.5 million tons per year.

4. "Alexander Milenov" -- 1 million tons per year, stripping coefficient, 2.3 Thickness of the vein 20 m.

The following deposits of lignite are also being developed by means of the surface method of mining:

1. The open mine "Bol'shevik": 1.4 million tons per year, stripping coefficient 1. Vein thickness 20 m.

2. Open mine "Chukurovo": 0.6 million tons per year, stripping coefficient 4.8. Under construction.

3. "Maritsha-East": 10 million tons per year, stripping coefficient 2.8, thickness 20m. Also under construction.

Open mines are cut into the vein by means of trenches. The dug-up soil is transported by means of rail lines, and only "Chukurovo" uses a system of stripping that employs no transportation but a EShCh-40 excavator with double shoveling.

The new open mine "Chukurovo II" is designed for normal steam-propulsion transportation.

The "9th of September", the "Republic I" and "Bol'shevik" have a narrow-gauge line (900 millimetres) upon which 30-ton locomotives of Polish and German manufacture, as well as German made 4-cubic-metre capacity dump cars, are employed.

A normal railroad line (1435 mm) has been built in "Republic III", "Alexander Milenov" and "Maritsa-East". Dump cars with a 30-cubic-metres capacity and 100-ton locomotives are employed on those normal tracks. Maritsa-East is marked for a change to electrified hauling.

At the "9th of September", at "Republic I" and at the "Bol'shevik", the coal is transported by rubber-conveyers of Bulgarian manufacture, while at "Republic III" and "Alexander Milenov" the same is accomplished by means of 50-ton gondola railroad cars. Drilling of rock is done with the drilling machine BU-2, that of coal by a PBS-110 of Soviet manu-

facture.

In order to mechanize the work at the surface mines, the following equipment is used: excavators SE -3 and EShU-40 of Soviet manufacture; Skoda E-25, E-23, - E-1003, RS-315; locomotives and dump cars with 30-cubic-meter capacity and Soviet made gondolas with a 50 ton capacity; bulldozers D-271 with the C-80 tractor; D-183 scrapers with the DT-54 prime movers.

The dumpings of the open coal mines are for the most part external, because the veins are steeply descending ones. Those dumps are equipped with excavators.

Internal dumps exist at the open mine "Chukurovo", while at "Bol'shevik" and "Maritsa-East" (under construction) such dumps amount to 50%.

The stripping-coefficients for individual deposit areas, for which the surface method is planned, is presented in Table 6.

Table 6

Coal and Deposit	Stripping Coefficient
Brown	
Dimitrovo	2.0
Lignite	
East Marish	2.8
Belobresh	1.5
Chukurov	4.8
Kurilov	2.0
Stanyan	3.0
Aldomirovtsy	1.5
Golubov	2.7
Average	2.8

The worker's labor-productivity at the open coal mines (including work of initial excavation digging to the vein) amounts to 4-8 tons per shift, but at the "Maritsa-East" (under construction) it will be 34 tons per shift.

MECHANIZATION OF PREPARATORY AND CLEARING WORK.

Considerable work has been done during the recent years in Bulgaria to mechanize labor-consuming processes in the mines.

For the underhewing of coal in preparatory work, coal-cutters "Eykgoff", "Kofman" and others are used.

Employed in clearing work are coal-cutters GTK-3 and KMP-1 of Soviet manufacture, "Eikhoff" and WLE-405 of foreign make and also the combines "Donbass-1" and "Gornyak".

Miner's picks are of Bulgarian and Soviet manufacture.

Employed in clearing and preparatory work are conveyers of Soviet (SKR-11) and Bulgarian (VT-2 and VT-3) manufacture.

In the assembly drifts various kinds of conveyers, mainly of Bulgarian make, are employed.

In sloping excavations haulage by means of the "endless rope" is employed in addition to rubber conveyers. Manufacture of winches for this kind of haulage and with lifting power of 1500, 3000, 5000 and 7000 kilograms has been carried out by the Stalin plant (in the city of Dimitrovo).

The coal is transported along main haulage excavations by electro-motives: those operating by contact [with rail] with a pull capacity of 8 tons, and those operation with batteries. Of the latter there are two types: the Soviet (2-ARV) and the German(EL-8).

Employed for the drilling of bore-holes in coal and rock are pneumatic drill-picks of Soviet and Bulgarian makes.

Shunting work at the loading points is not mechanized.

Used in loading, as yet on a very limited scale, are loading machines S-153, EMP-1 and also machines manufactured by the Stalin works (the city of Dimitrovo), such as the Altynov system machine and the scoop S-104 (of the EMP-1 type). Owing to large gabarits, the loading machines have not received wide use, and therefore before the designers and machine builders of Bulgaria stands the task to create convenient loading machines which could be used in narrow one-track excavations.

In the Bulgarian mines, where brown coal and lignite are produced, work is organized in three 8-hour shifts, with the exception of Saturday and Monday when the duration of shifts is 6 hours. Sunday is the day off. As a rule, the clearing faces have two producing shifts and one for repair and preparation. About 25% of the clearing faces work according to the cyclic schedule, fulfulling one cycle every 24 hours.

Work in hard coal mines is conducted in 28-hour shifts.

Anti Gas and Dust Measures

Suddeh eruptions of coal and gas in hard-coal mines usually commence at the depth of 300-400 meters, but in the mines of the Bulkan deposits from 150 m.on; this is explainable by the especially intensive techtonic processes of the past.

The first instance of sudden eruption of gas and coal in the hard-coal mines of Bulgaria was recorded in 1900. There have been about 100 eruptions of varying strength between 1900 and 1956. The amount of coal thrown out in one eruption amounts to 15-100 tons; this quantity

is usually smaller at lesser depths than at greater ones. There is reason to believe that as mining work is carried to greater depths the intensity of eruptions and the volume of erupting coal will increase considerably, this will create additional difficulties in the exploitation of the Balkan hard-coal deposits.

According to the results of observations, the sudden eruptions of coal and gas occur predominantly where coal veins are crossed, when rakes are being conducted, in the corners of clearing and preparatory mine faces.

Observations make it possible to divide the sudden eruption of gas and coal into: a) the actual eruptions of coal and gas proper; b) sudden pouring-out of coal; "c" softening and squeezing-out of coal.

In the Balkan deposits which are, dangerous in terms of sudden gas and coal eruptions and gas, the following measures are employed:

1) mining of protected veins; 2) degasation of veins which are dangerous in terms of gas, by perpendicularly to the surface of the vein; 3) special methods of intensive bracing of mine faces; 4) Concussive explosions between shifts; 5) other safety measures employed in gasogenic veins.

The most effective measure in the prevention of sudden eruptions of coal and gas is the mining of protected veins located directly above or directly below the exploited vein.

In veins which are especially dangerous as far as sudden eruptions are concerned, consecutive work is conducted in preparatory and clearing faces; work is not done simultaneously in both.

In order to combat dust, drilling with flush-rinsing is employed. In order to prevent sylicose afflictions, the drillers use masks of Bulgarian, French and German manufacture.

Such means for combatting dust as the use of inert dust, spraying of mine-faces etc, widely used in the mines of the Soviet Union, are not employed as yet in Bulgarian mines.

THE DYNAMICS OF COAL PRODUCTION BY YEARS

The growth of total coal production in Bulgaria from 1930 to 1956 is depicted in Table 7:

Table 7

Year	Total production (in 1000 tons)	Year	Total Production (in 1000 tons)	Year	Total Production (in 1000 tons)
1930	1593	1939	2297	1948	4260
1930	1522	1940	2765	1949	5360
1932	1759	1941	2997	1950	5903
1933	1584	1942	3667	1951	6413
1934	1646	1943	3847	1952	7410
1935	1676	1944	3014	1953	8345
1936	1678	1945	3562	1954	8925
1937	1853	1946	3512	1955	10046
1938	2088	1947	4041	1956	10810

The relentless development of the coal industry, as well as of all other branches of the national economy, in the people's Republic of Bulgaria bears witness to the fact that the Bulgarian people, creating rapidly a firm economic foundation for the socialist transformation of their country, are confidently marching upon the path of building of an even brighter future.

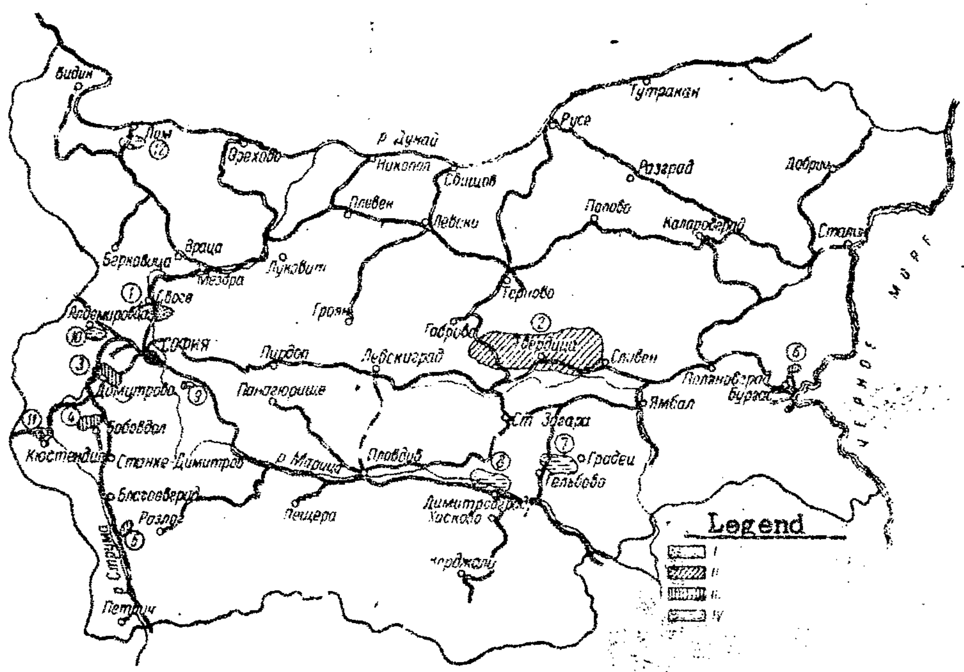

Fig. 1. Schematic Map of Natural Coal Deposits in Bulgaria:
I, anthracite; II, hard black coal; III, brown coal; IV, lignite; 1, Svoge; 2, Balkan; 3, Dimitrov; 4, Bobovdol'; 5, Pirin; 6, Black Sea; 7, East Marish; 8, West Marish; 9, Chukurovsk; 10, Aldomirov; 11, Kyustendil'; 12, Lom.

Fig. 2

A Schematic Geological Cross-Section of the Dimitrov Coal Deposit Expoloited by the Subterranean Method.

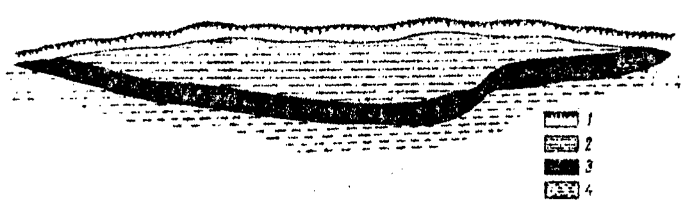

Fig. 3

A Schematic Geological Cross-Section of the Dimitrov Coal Deposit Being Exploited by the Surface Excavation Method; 1, soil; 2, marl; 3, coal; 4, clay.

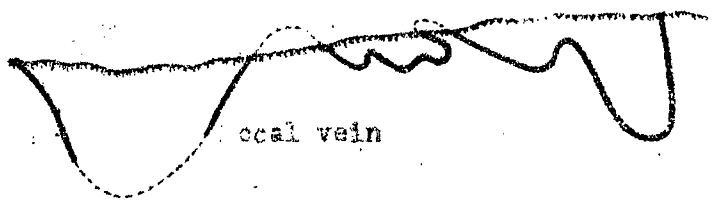

Figure 4.

A Schematic Geological Cross-Section of the Bobovdol' Coal Deposits.

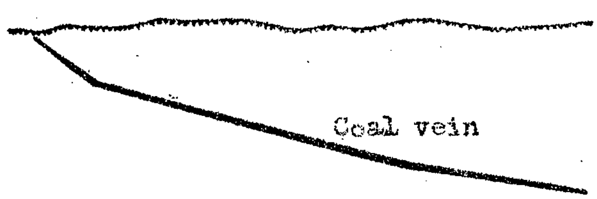

Figure 5.

A Schematic Geological Cross-Section of the Black Sea Coal Deposit.

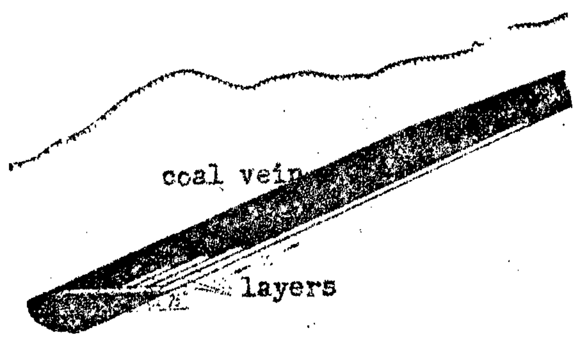

Fig. 6.

A Sketch of the System for Exploiting the Pirin Coal Deposits.

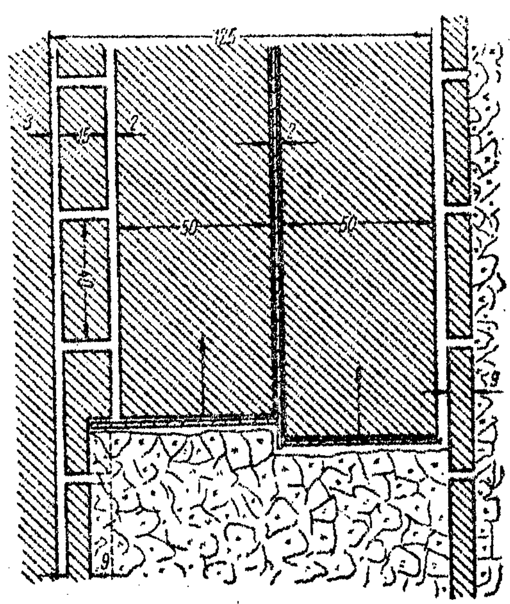

Fig. 7

The System for Exploiting the Dimitrov Brown Coal Deposits

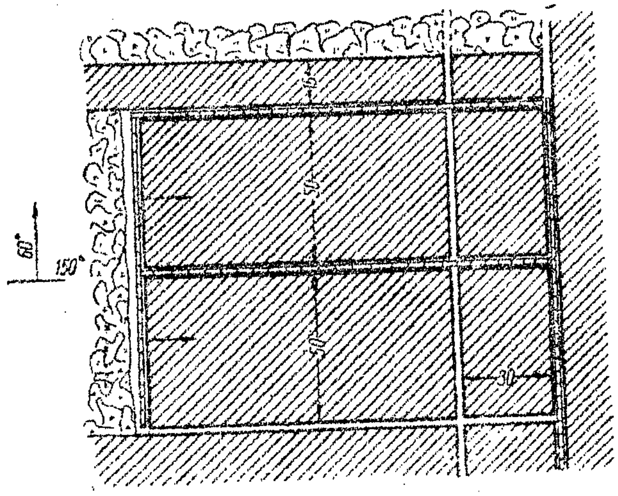

Fig. 8.

System for Exploiting the Bobovdol' Brown Coal Deposits.

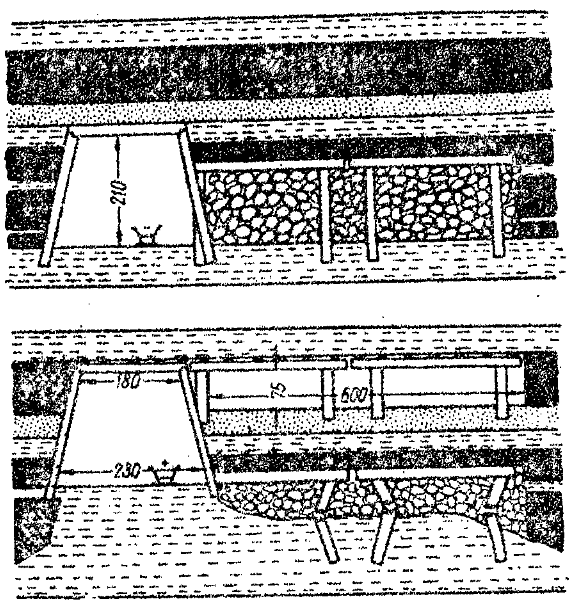

Fig. 9.

System for Exploiting the Black Sea Brown Coal Deposits.

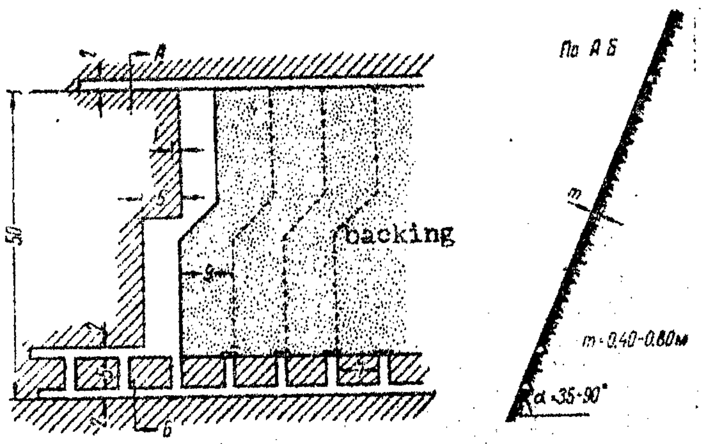

Fig. 10.

The System for Exploiting the Steeply Descending Coal Veins of the Balkan [mountains] Deposit.

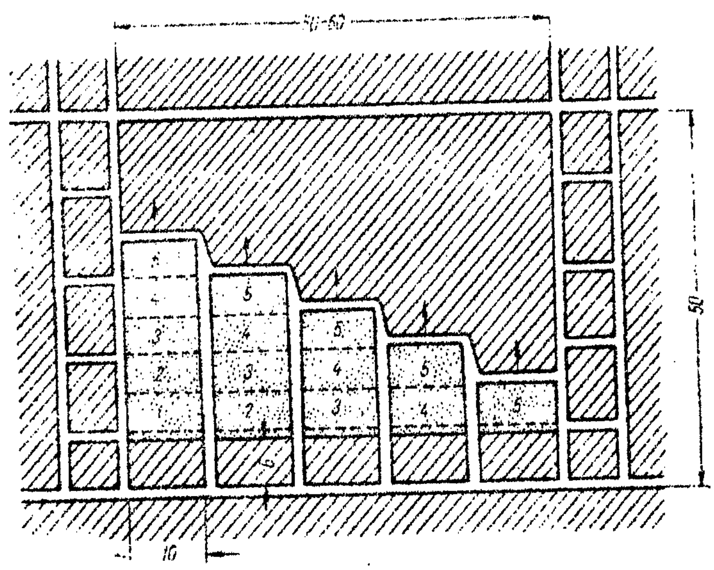

Fig. 11.

The System of Exploiting the Balkan [mountain] Coal Deposits by Means of Ascending Step Units.

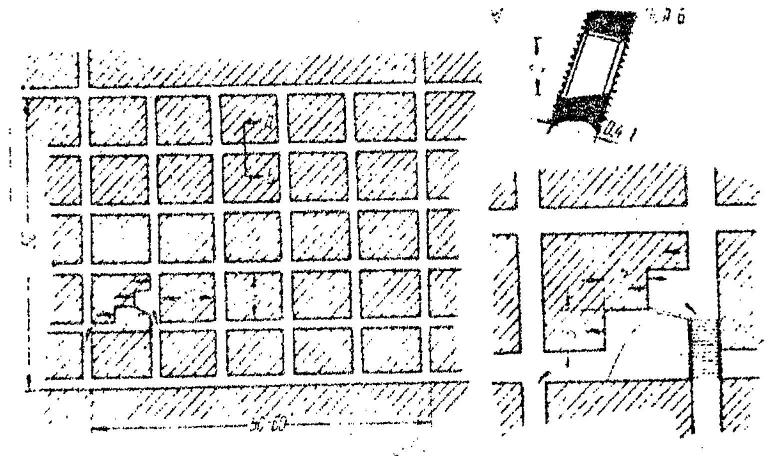

Fig. 12.

The System for Exploiting the Balkan [mountain] Hard Coal Deposits Through the Whole Range of Worked Strata.

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CZECHOSLOVAKIA

THE GAS INDUSTRY DURING THE THIRD FIVE-YEAR PLAN

[Following is the translation of an article in Ceskoslovensky hornik a energetik (Czechoslovak Miner and Energy Worker) Vol 1, No 14, Prague, 8 April 1961, page 3.]

A technical-economic conference took place in Karlovy Vary on March 28-30, 1961 for the purpose of evaluating the progress of the technical standard of the gas industry in CSSR during the second Five-Year Plan and of assuring the technical development in the years 1961-1965. Hundred-forty technical and economic workers from the Gas Research and Project Institute, from national gas works, from the coke and gas department of the Chemical-Technological College, from the Association of Gas Producers and from enterprises manufacturing and using industrial gas equipment, participated.

After listening to reports the participants divided into three specialized groups to discuss the present state of the technical development and to make recommendations regarding the raising of technical-economic standards in the gas industry in the third Five-Year Plan. We list some parts of the conslusions at which the technical-economic conference arrived:

In the field of gas production by pressure method from lignite in the sector of mechanical preparation of coal examine the possibility of drying processes for clay [loam?] coals, including the effect on the function of electrofilters and the possibility of assuring the regulation of coal drying, and investigate whether domestic manufacture of equipment for the transportation of coal for high power would be efficient.

Continue in the sector of gas production with further intensification of the ϕ 2.6 m generator to the output of 12,000 m^3 of raw gas per hour. Ascertain the efficiency and economy of obtaining gas from coal with high ash content from the Petipes Basin. Solve the further development of central ash removal from the generator in connection with continuous hydraulic ash removing processes.

Solve the process of deodorization in connection with the new methods of odorless gas production and refining.

In the sector of cleaning of waste water, aim at a technological regiment of pressure gas production, in which the producing process is such that the amount of penolated water is reduced. Test the permeability of the underlayers of the natural ash deposits

with regard to the danger of ground water.

In the sector of cleaning combustibles, develop a method for sulphur removal with partial use of 15 percent ammonia water.

Further develop a cyclone furnace. Aim at comprehensive automation of partial processes in the pressure gas plant.

In the field of low-pressure gas production and refining. In the sector of cracking of gaseous hydrocarbons, use the cracking plants not to cover basic output, but as top sources. Build them in places where there is concentration of gas demand in larger towns, and do not count on long distance delivery.

Pay attention to the development of cracking plants for liquid hydrocarbons based on the systems of using a circulating catalyzer, and further learn the technology of cracking with a solid catalytic basis.

Perform comprehensive work test at the cracking plant Kosice I. Test over a long period the working parameter of the nickel catalyzer on a magnesite carriage at the cracking plant, made through the reconstruction of the two-gas generators at the K. Gottwald gas works in Prague. Test the level of the maximum profitable limit of organic sulphur and HCN content in coke gas, used for underground storage.

Work intensively on research and development of all kinds of catalyzers and assure their production.

In the field of distribution and consumption of gas, rely, in the increase of output of city networks, on two systems: the medium-pressure and low-pressure systems. On the basis of this, it is necessary to ascertain consumption and make sure of the production of medium-pressure regulators. Make technical-economic evaluations of the most appropriate locations of low-pressure regulators.

Follow systematically the consumption diagrams on long-distance city and local gas lines. Utilize the analogous electrical models for the solution of town networks.

Speedily build a cathode protection of gas lines against corrosion. Equip the components of anti-corrosion protection with personnel and material, complete the comprehensive project of installation and put it in operation. Achieve economic construction of regulatory stations by using type projects and introducing panel construction.

Further, there are proposed measures for increase in efficiency and in the safety of the gas consumer, for help in solving the problems of providing gas to industrial plants and others.

Gas works, the research and project institute, and the association of Gas Producers are now presented with the job of developing a concrete plan to carry out the conclusions at which the technical-economic conference arrived.

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CZECHOSLOVAKIA

THE IMPORTANCE OF INVESTMENT CONSTRUCTION IN FULFILLING ECONOMIC-POLITICAL TASKS OF THE COAL INDUSTRY

[Following is the translation of an article by Liboslav Stanek in Uhli (Coal), Vol 2, No 12, Prague, December 1960, pages 301-302, 318.]

Investment construction proposed in our third Five-Year Plan and approved by the state conferenc e of the KSC [Czechoslovak Communist Party] reaches the extent of 322 billion Kcs, that is about 59% more than the investment during the second Five-Year Plan. The investment resources used for industrial development will be almost 88% higher than in the second Five-Year Plan.
It is necessary to use these resources most effectively. We are aware that during the third Five-Year Plan we will build plants which will operate also during the era of Communism. Therefore, we must achieve both in newly planned and in reconstructed plants a high world standard in effectiveness of investments, technology, and economy of operation.

In recent years we have built in the fuel branch a number of new quarries, mines and workshops, of which we need not be ashamed. However, there have been deficiencies in investment construction which we must correct. In the sector of preparatory planning, the timely completion of investment tasks is not assured, and the investors do not always pay enough attention to the efficiency of the construction and the future profitability of the enterprise or plant.

Investment tasks are seldom based on prospect studies, although present department investment policy is oriented toward comprehensive uitilization of fuel resources which necessitates solving the interrelation in the field of fuels, as well as in the fields of energy, gas, and chemistry, and possibly in other fields. These facts unfavorably affect the project planning.

On 17 and 18 October 1960 a conference was held, at the fuel and energy ministry, of deputy directors of the construction association, and directors of project and construction organizations and their technical deputies. The conference reached several conclusions on investment construction.

In hard coal mines, in planning new mine fields, or unworked mine tunnels the length of walls should be on the average 200 meters, as far as the size of the tunnels and natural conditions permit. In order to make operation in these long walls safe, the newest reinforced support equipment should be preferentially installed.

In projects of new cuttings, hydraulic equipment should be considered. According to theoretical figutes, the lengtehning of walls from 100 to 200 m means a saving in shifts in the mine up to 20 percent due to saving in drilling, transporting and maintenance. Therefore, it is necessary to achieve a fast increase in the wall lengths, to check the technical-operational projects of enterprises, especially in the Ostrava-Karvinna region, for the third Five-Year Plan and assure the production of efficient rake-movers corresponding in length and capacity to the walls. For flat seams, combines should be proposed. The development and importation of mining combines should be assured for more efficient extraction and sorting with less waste.

It is desirable to improve the state and level of mechanization in horizontal mines. Therefore, more efficient boring hammers must be obtained and quality boring steel and air pressure amplifiers of the type ZT 4/8. We must also develop and manufacture a new type loading machine with a larger bucket(capacity, .3 m^3) or one which works continuously. It is necessary to import a stamping combine of the type PKG-1 or similar from the USSR. The use of combines for stamping of low-power kinds of coal is also necessary.

In the Most and Sokolov regions the transition to open pit mining should be considered as the basic direction of technical development. Going to the depth of 250 m and more we must achieve by 1970 95% of the yield by the quarry method. Choose the quarry units as large as possible so that one-wing quarries achieve a capacity of 5-7 million tons a year and two-wing quarries 10-15 millions tons; and this both in new and reconstructed quarries. Use efficient heavy machinery with continuous production. For moving coal, use belt conveyors with speed of over 5 m/sec. All auxiliary jobs should be comprehensively mechanized and the coal should be further worked in large plants with capacities as large as possible in given conditions. Use the largest technological units of up to 300 tons per hour capacity. Use soft coal in large pressure gas works, energy-technological combines, and, mainly, in large thermo-electric plants. Find ways by presently known methods to utilize the brown coal which cannot be obtained by conventional methods through underground gas production. In construction, use large prefabricated units and montage elements on the basis of unit typification.

In the Slovak mines and the Sourth Moravian lignite region, the principles of maximal mechanization and automation, economically efficient construction and maximal profitable extraction of the deposit will have to apply in new projected fields. In all regions, local basic conditions should determine the organizational structure of mines and sectors and the optimal size of mines and sectors.

In the South Moravian, South Slovak and partly in the Handlova regions, mechanization of mining with the help of extraction

combines and new support equipment should be planned. Continue in the Novaky and Handlova regions to solve the extpaction problem of seams over four meters in size, particularly by the method of interceiling and overceiling extraction.

In all regions the projects must aim at a permanent increase of capacity. In projeeted preparations and opening, use should be made of panel supporting equipment, vertical parts of precast concrete lowered in large pipelines.

In the South Moravian lignite region, consider the method of freezing the basic method for deepening under conditions of water-containing sands and strata. Extend the use of belts for transportation by concentrating the cutting areas, Lengthen the belt conveyors and thus limit to a minimum the number of slides and size of work crews, and increase the automation of the belt conveyors. Solve the problem of crushing by installing crushers before the coal reaches the main belt conveyor. In wheel transportation, provide automation of loading stations and car lines and provide electrification of local transportation. Mechanize the transport of materials, substances and equipment. In order to lower the maintenance of shafts, care should be taken that only the most necessary laterals are dug and as little as possible ahead of their operational use. Also determine a kind of support for these laterals that would require the least maintenance for the duration of their usefulness.

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CZECHOSLOVAKIA

PROSPECTS AND POSSIBILITIES OF SHORTER WORKING HOURS IN MINING

[Following is the translation of an article by Stanislav Hachran in Uhli (Coal), Vol 3, No 2, Prague, February 1961, pages 60-63.]

Already in 1960 a shortening of the working time to 40 hours a week underground and 42 hours a week above ground was initiated in selected plants of the coal industry. This year the entire coal industry will change over to the shorter work week. Experiences gained so far in enterprises and plants are being evaluated and results contribute to the successful carrying out of this significant economic-political task.

By the decision of PB [Politburo?], UV KSC [Central Committee Communist Party] of 8 December 1959 and of the government of 29 January 1960, directions were given for the summary hypothesis to 1975 to develop as part of the long range plan comprehensive measures necessary to shorten the work week by 1975 to 30 hours a week above ground and underground to 25 hours a week on the basis of the increase of hourly productivity.

According to these principles in the long range plan to 1975 these gradual decreases in working hours in the coal industry are expected:

Number of hours weekly per worker	1960-1965	1966-1970		1975	1980
Underground	46-40	35	30	25	25
Above ground	46-42	40	35	30	30

This presupposes that already during 1965 or still earlier some plants would be experimentally working 30-40 hours a week in order to make it possible to introduce this working time at the beginning of the fourth Five-Year Plan. Therefore, it is necessary already at the present time to deal with the practical problems of further shortening of working hours, since already the first variant of the long range plan which will be made at the beginning of 1961 will be based on part studies of the particular components of the plan.

At the creation of the summary hypothesis to 1975 by decision of the Party and Government, it was necessary to develop as part of the long-range plan measures needed to shorten, on the basis of the growth of the hourly productivity rate, in 1975 the work week to 30 hours with the assumption that the work week underground will be shortened to 25 hours.

To this long term study was applied the experiences gained so far. The main job in this direction remains creating the proper conditions to cover maximally the decrease in working time by increase of labor productivity.

Utilization of Available Time

The basic problem which arises with shortening of working hours is the question of how to replace the loss of working time and maintain the planned production goals and labor productivity. If we compare the working hours per worker underground in 1960 (46 hours) and 1975 (25 hours), we have a decrease in working hours of 46 %. On the assumption of covering the decreased working time 100% by growth of labor productivity, this would mean theoretically an increase in speed of about 84%. With this are connected better use of available working time, the need for rapid technical progress, the availability of labor, and other things.

It will be necessary to give attention to a thorough analysis of utilization of the time fund, separately in the mines and separately above ground, since the shortening of working hours will result in different hours in mines and above ground and the work regimen will require a different organization of work. The analyses of the time fund will have to be carried out along two lines. One must concern itself with lowering of absences, and the other with the utilization of the net work time fund (work time after deducting absences).

1. Lowering of absenteeism

By absenteeism we understand all influences which decrease the time fund after deducting holidays, Sundays, vacations, illness, accidents, and other influences. A source for raising the work time fund is a minimal part vacation with the shortening of working hours to 40-42 hours from 6 to 5 days a week, since the new directives regarding vacations, contrary to previous practice, count five working days as one week. One cannot count on this source if with further shortening of hours the work week remains five days. The mentioned change in figuring influences abseneteeism favorably only if judged in relation to the original working hours and vacations.

Attention must be paid to other aspects of absenteeism and their lowering, since the shortening of working hours itself creates favorable conditions for it.

As for other kinds of absences, such as state or public duties, other legal absences, time off given by the plant administration, and other absences, there will be various ways of reducing them or entirely eliminating them. The shortening of working hours will make more and more free time available and parts of it can be used for these civic and required duties which at present are performed at the expense of working time.

A considerable part of absences are caused at the present time by illness and accident and they can be lowered by efforts to provide proper working conditions.

2. Utilization of the working time available.

Another set of problems is created by the most rational utilization of the available work time. Besides the problems connected with elimination or reduction of unproductive periods, waiting, and other times not worked during the shift, the main significance at the gradual shortening of working hours will be in the organization of the operational and work regimen. Here belongs the question of increase of shifts and use of capacity.

At the simultaneous shortening of working hours to 42-40 hours per week the principle will be applied that in underground mines which where up to the present worked in two shifts, three or possibly four shifts will be worked in order to achieve equal capacity distribution in a 5-day 40-hour work and operational week. Uninterrupted operation will be maintained in technologically continuous production processes (coke-ovens and furnaces, soft coal pits) and where it is economically useful.

In all other production processes above ground there will in principle be a 5-day week operation with a 42 hour work week and one out of four saturdays will be worked.

If we start from this assumption, there exist several possibilities, according to concrete conditions, of how to arrange the operational and work regimen of plants and enterprises when gradual reduction of working time is introduced. We exclude for the time being the possibility that for political or economic reasons we might have to return to the 6-day work week.

Maintaining a 5-day week and working the mentioned number of hours per week would affect the working time per worker per day as follows:

	1960-1965	1966	1970	1975	1980
Underground	8	7	6	5	5
Above Ground	8*)	8	7	6	6

*) Three weeks of 5 days at 8 hours and the fourth week of 6 days at 8 hours.

The mentioned arrangement can be considered as basic, and it is correct to use it as a starting point also for other alternatives. It is the basis for arranging working hours when we assume that in one week 25-30 hours will be worked in 5 days and the same number of hours per shift.

It is known that a considerable part of the 8-hour work time is in some mines time spent not actually working, and this depends on various objective and subjective factors (length of the trip to the place of work, difficult mining conditions, descent and ascent, insufficient work organization, etc.) Introduction of the five-hour shift would leave a very short productive part. A further increase of shifts to 24 hours would burden the mining equipment considerably and the transportation systems with moving the crews. The capacity of the mining equipment and the transportation system is already with the present shortening of working time in a difficult situation. A further disadvantage from the point of view o f the workers would be the disproportion between the time spent on the way and the working time. Advantages of this work regimen would be a more equally distributed use of public transportation, and improvement in some working conditions, like presence of dust, atmosphere polution and temperature, although these are already being improved practically and through research. It is possible that further progress, particularly in technology, will make this length of shift possible by 1975-1980.

A quàte contrary consideration is retaining the 8-hour shift while introducing the shorter working time. Here it is necessary to say that any other kind of organization except a basic rearrangement of work and operation regimen with a shift of a certain constant duration, contains two possibilities. Either have an alternate off-period after working the appropriate number of hours per week, or maintain the five-day work week and increase by the proper number of days or weeks the legal vacation and have one single off-period. This could be achieved only by stages.

Whatever the advantages and disadvantages of this arrangement of working an eight-hour shift and 40 hours per week might be, it would mean that after working this number of hours the worker could claim 15 hours of time off besides Saturday and Sunday. This would require a considerable number of additional workers. Yearly

productivity would drop considerably even if at the same time the hourly rate of productivity grew. Moreover, it would be difficult to obtain the additional number of workers. If according to this regimen we disregarded the earned days off, serious difficulties would result on account of the extensive use of machinery and equipment. Intensive use would grow to excess. This way might be applicable in the first stages of the shortening of work time, when workers could be reassigned to shifts and locations according to the days and hours they had already worked. This solution does not, however, affect the problem of shortening, besides working hours and weeks, also shifts and the length of difficult underground assignments.

According to preliminary studies based on the advantages and shortcomings of the two listed methods, the following arrangement might be recommended as most useful for the coal industry:

Hours per worker per day	1960-1965	1966	1970	1975	1980
Underground	8	7	6	6	6
above ground	8	8	7	6	6

Underground workers would then from 1975 on work in some weeks 30 hours or 5 hours more than their anticipated work week. Therefore, the need for compensating time in the following weeks will arise which could be arranged for in longer or shorter intervals in the course of the year.

COMPARISON OF TWO ALTERNATIVE WORK TIME REDUCTIONS

Indicator	Unit of Measurement	Without short. of work time	After short. Saturdays 5 hr/sh	Without 6 hr/sh. Wed. off
No hours per worker per week in mine	hour	46	25	30
above ground	hour	46	30	30
No of working days per week	days	6	5	5

No of working days per year	days	307	255	255
Work time fund per worker after deducting absence time in mine	days	248.95	206.9	206.9
Above ground	days	255.95	213.1	213.1
Days worked in mine	days	248.95	206.9	172.4
Coal production per year	1,000 ton	1,000	1,000	1,000
Coal production per day	ton	3,257.3	3,921.5	3,921.5
No of workers total	persons	2,000	2,000	2,000
of these in mine	persons	1,700	1,700	1,700
above ground	persons	300	300	300
Labor productivity per worker per year	ton	500	500	500
No of shifts total	shift	500,000	415,694	357.066
in mine	shift	423,215	351,764	293,136
above ground	shift	76,785	63,930	63,930
Total output	t/hl/sh	2.0	2.4056	2.800
Total output per hour	t/hl	0.2608	0.467	0.467
Mine output	t/hl/sh	2.3628	2.8428	3.411
Mine output per hour	t/hl	0.3069	0.5685	0.5685
No hours per worker per shift	hours	7.666	5.15	6

No hours per worker per year	hours	1,916.66	1,071.2	1,071.2
No hours of all workers per year	hours	3,833,333	2,142,400	2142,400
of these hours worked in mine	hours	3,258,333	1,758,820	1758,820

[Abbrev.: Hr = hour, t = ton; hl = ?; sh = shift, No = number]

The solution of theproblem of this variant can be approached in a manner similar as in the example in the table on page 7.

It follows from the foregoing that the speed of growth in hourly output will have to be considerable in order to compensate 100 percent in labor productivity for the decrease in the work-time available.

The comparison of the two alternatives of five-hour shift and six-hour shift with more free days is incomplete because the production of the mine should be higher in the 172.4 days worked in the six-hour shift, and the number of working days should decrease from 255 days to about 220.5 days with an increase of daily production to 4,535.5 tons. The capacity of the mining equipment would be by this on some days markedly strained and on others left unused. It is, therefore, necessary to leave the production spread over 255 days. The number of shifts is here not quite accurately expressed economically. If the number of workers does not change, the number of shifts do not decrease either. It is, however, obvious that we are dealing with a different number of days and hours and therefore, also a sifferent length of shift.

With regard to this, there is in the six-hour shift a difference regarding the basic variant only with workers in the mine, and since it is necessary to maintain a daily production of 3,921.5, tons the following relationships follow:

Indicator	Unit of Measurement	r hr/shift	6 hr/shift altern. time off
No of days worked in mine per worker	days	206.9	172.4
Coal production	1,000 tons	1,000	833.171

Mine output per hour	t/hl/sh	2,8428	3.4113
Mine output per hour	t/hl	0,5685	0.5685
No of shifts in mine	shifts	351,764	244,233
No of production workers in mine	persons	1,700	1,416

The raising of the number of hours from five to six and the need to maintain the daily production at 255 days indicates the necessity of spreading the workers over all days, which is made possible with the additional 284 workers.

Three 8-hour shifts or four 6-hour shifts in 24 hours form the most practical closed production and operation cycle in the mine. Seven- or five-hour shifts do not form such a hearmonious whole. If we do not consider this relation of shifts and the regular change of workers during 24 hours, we are left with a three hour time reserve the utilization of which we must weigh. The shift of this duration may be considered not only for the 35-hour, 5-day work week, but also with further shortening to 30 and 25 hours. In that case the working hours would have to be arranged in this way:

hours per worker per day	1960-1965	1966	1970	1975	1980
Underground	8	7	7	7	7
Above ground	8	8	7	7	7

It appears from this that the number of days off after working 35 hours with obligation to work on ly 25 hours in 5 days would be twice as large as in the preceding alternative. Even so this alternative is applicable to solving the sh ift problem and we should use it temporarily for gaining necessary experience. It may be used for the years 1966-1970, but it cannot be considered as a solution from the point of view of the future Communist society, just as one can not consider the five-day week as the last step.From the mentioned aspects it follows that it will be correct to count on developing long-term plans mainly on the basis of the six-hour shift.

Technical progress and shortening of Work Time

The main source for compensating for the drop in working time must be found in technical development. Even though it is often emphasized that technical development has had considerable successes in the field of mining, there are certain problems connected with further technical progress. The direction of technical development, like comprehensive mechanization, automation, electrification, etc., are known, but the concrete expression of this direction, as, for instance, the technical-economic parameter of the new machines, equipment, and technological advances, on the basis of which it would be possible to make and document a long-range plan, are not at all, or only in rough outline, worked out. In some cases the conditions in which they would have to be applied, are not yet known. For instance, coal deposits in new localities are being considered where the geological investigation is not yet completed.

With present knowledge and under certain conditions it is possible to develop the possibilities to which these indicators and starting assumptions will apply. Among the assumptions which have a basic significance for the direction of further technical development are, for instance, the amount of production, the extent of seams, the surface cover, the expected further advance in depth in deep and surface mines, greater demands for washed coal, etc.

One can agree with the fact that presently neither here nor abroad, is there sufficient experience with the conditions in which mining will operate in the 1970-1980 period and after. Considering the necessity of mining here in far less favorable job conditions than elsewhere, it will be necessary to find our own ways of technical progress.

The main question which is often asked in this connection is to what extent can we count on technical progressin achieving more growth of labor productivity with shorter work time, or to what extent is the speed of growth of labor producitivity real.

It is, of course, necessary to know for this purpose thoroughly the purposeful and progressive character of the long-range plan. Although conditions in mining are much more difficult for technical progress than in other fields of industry, it is necessary to concentrate even more effort on technical development in this field and thus facilitate recruitement of labor.

Physiology and Work Hygiene with Shorter Working Hours.

With the shortening of working hours emphasis is placed on the introduction of effective measures to protect health and increase working ability.

Increase of labor productivity cannot be obtained by intensifying the physical output of the worker. In this, technical progress must effectively help out. From the point of view of work physiology,

it matters what kind of mechanization is introduced. It is necessary to introduce comprehensive mechanization and automation. It is not correct to place non-mechanization and automation. It is not correct to place non-mechanized activity between mechanized operations, because the speed of human work is then determined by machines and not only is then a fast and intensive performance required, but it also leads to more fatigue and wear on the worker and to his earlier elimination from the work process. If we intensified the work rate we would need workers not only to compensate for the decrease of working time, but also for the premature wearing out of the labor force.

With the introduction of mechanization, there appears noise at the places of work which has an unfavorable influence on the work activity of man, and for this reason workers do not like to work with noisy machinery. Such machinery will have to be gradually eliminated or their operation directed by remote control.

An even more important factor with much influence on the efficiency and health of the worker is humidity, temperature, and mainly the dust in the atmosphere in mines. Occupational diseases are steadily declining. However, there are frequent cases where there is insufficient observance of basic hygienic measures and cases of silicosis occur after only five years of work in the mine. Both technical and hygienic steps must be taken. Shorter working hours make a shorter stay in difficult working conditions possible; they do not change these conditions, but permit a longer rest period afterwards.

The intensity of work is also unfavorably influenced by lost time on auxiliary jobs. Workers on these jobs often give a higher physical performance than on mechanized jobs, but their work effectiveness is insignificant in comparison.

Looking at the length of shifts from a physiological point of view and at the shortening of work time to 25-30 hours, it can not be decided from a health standpoint whether it is preferable to choose a six-hour shift with fewer days off or a seven-hour shift with more days off besides Saturdays and Sundays. It will be decisive how the safety and hugienic measures for the health protection of man is solved. A certain regularity in the changing of shifts should be observed. According to our experience the weekly change of shifts is most usual and accepted. Various obstacles would arise if we attempted to change this order. With the shortening of working hours it will be useful to lower mainly the night shift, which for biological reasons has an unfavorable influence on the efficiency of man, and which, especially when alternating day and night shifts, influecne his social and family life. It may be useful to consider in this regard whether it might be convenient to change the beginning of the morning shift to a later hour, like 7 or 8 o'clock, instead of 6 o'clock, which would also have a favorable effect on the

activity of the workers.

According to preliminary experiences with shortening of work time there is not yet enough attention paid to the improvement of the work environment and preventive measures. Physicians hygienists together with the management of the enterprise should determine concrete conditions, or work out measures that are necessary and workable from a health standpoint, so that the enterprise can introduce a shorter work time. The enforcement and control of these measures could be carried out by the ROH organization.

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